Obesogenic Environments: the built and food environments current evidence.

Abstract

INTRODUCTION

Ten years ago, the concept of obesogenic environments was relatively new and brought together evidence that linked the built and food environments in novel ways [1, 2]. In the interim period, research exploring how aspects of the built environment may contribute to current obesity levels - by influencing physical activity and dietary behaviours at individual and community level - has burgeoned. However, as frequently stated, while the basic drivers of obesity are simple (more energy consumed than expended) the aetiology is multifactorial and complex [3]. Therefore, establishing causal pathways is difficult. Moreover, the plethora of approaches, methods, metrics and environmental variables that have been employed in studies makes cross comparison and the search for definitive evidence difficult [4].

In the meantime, the problem of obesity shows no signs of abating, and globally, has doubled since 1980 [5]. Latest figures suggest, by 2030, 48% of adult men and 43% of adult women in England will be obese [6]. While rates of childhood obesity in England appear to have stabilised, over a third of children are currently overweight or obese [7]. Obesity also has a strong socio-economic profile and disproportionately affects the lives of poorer groups in society, thereby contributing to growing health inequalities at all levels [8].

This paper will briefly outline current key themes relating to the influences of the built environment on physical activity and dietary behaviours. It explores themes of significance to the UK and highlights work on children and adolescents, since lifestyles set in this age group tend to track through to adulthood (as do overweight and obesity). It further focusses on the complexities of translating this knowledge into policies and suggests directions for future policy.

Methods

This paper is based on literature extracted from key-word searching of electronic databases. The databases used were Medline, SCOPUS and Web of Science. The data bases cover medical and social sciences plus humanities to reflect the interdisciplinary nature of obesogenic environment research. In addition a selection of journals known to carry papers on obesogenic environment were hand searched for completeness. A timeframe of 2006 to 2016 was used.

Built Environment and Physical Activity

The premise that physical design, land-use patterns and transportation systems may influence an individual's propensity to have an active lifestyle remains strong. Intuitively, neighbourhoods providing a range of local facilities within easy active travel (walking and cycling) distance, with good quality infrastructure (such as well-maintained pavements), which are regarded as safe and pleasant, in theory, should support physical activity. These type of environments are often referred to as 'walkable neighbourhoods' in academic literature; though supporting walking is only one element of physical activity.

Which aspects of walkable neighbourhoods might be more influential than others in encouraging active lifestyles, and therefore demand more focus and resource allocation, has been open to debate [10]. Adams *et al.* studied combinations of neighbourhood attributes and devised five neighbourhood typologies, which they then examined in 11 countries. They concluded that four walkability attributes – access to shops and services, high residential densities, sidewalks, and transit

(public transport) stops – were associated with residents meeting physical activity guidelines. However, neighbourhoods that were 'activity supportive', with local recreational facilities, cycling infrastructure and so on, promoted the highest levels of physical activity [11]. A study of 12 countries that correlated neighbourhood environments and walking, furthermore suggested significant factors were perceived residential density; land-use mix; street connectivity; aesthetics and safety; and walking for transport [12]. Perceived safety from traffic and close proximity to local destinations have been associated with lower BMI, with an assumption that walking for transport was the mediator [13].

The influence of greenspaces, such as urban parks, has also been a focus of interest. Early studies produced encouraging results, associating high quality parks near home with people being more active during recreational periods [14, 15]. In one study, parks were associated with recreational walking at levels that deliver health benefits [16]. Overall, however, studies associating greenspaces and physical activity have produced contradictory results. In some reviews, for example, park accessibility has been associated with use and physical activity [17-19] and inversely associated with BMI [20, 21]. However, others have suggested weak or null associations [22, 23]. This is not necessarily surprising. A systematic review of obesogenic environment papers included seven studies, associating physical activity and greenspace, but none of the papers used the same definition of this metric [4]. The review provides a good example of the problem of the multiple approaches, metrics, and definitions employed in obesogenic environment research since its inception [24].

An area of research showing progress over the past decade is the consideration of the multiple environments in which individuals spend their lives. Many early obesogenic environment studies used a single administrative boundary (or specified 'buffer') around an individual's home as a proxy measure of their home neighbourhood. However, this rarely reflects objectively measured, or perceived, reality [26]. Moreover, while behaviour is moderated by home location, for many adults a large proportion of any physical activity is undertaken away from the home neighbourhood [27]. Therefore, studies focusing on home neighbourhood are unlikely to capture an accurate picture of the influence of the built environment particularly in adult groups. Research has suggested that children and young people are also more mobile than often assumed [28, 29].

Active travel (walking and cycling) to school is another area where debate has progressed in recent years. Here, research has emphasised that promoting and maintaining active travel to school is significant in incorporating physical activity in young people's lives [30, 31]. Moreover, recent research has demonstrated that maintaining active travel through adolescence is associated with reduced BMI scores in young men [32]. Key environmental predictors of active travel are distance to school and parental perceptions of road safety and the inconvenience of using a car[33]. Threshold distances of 1.4km for 10 years olds increasing to 3km for 14 year olds have been established [34] and recent work reiterates that children avoid busy roads. However, the impact of other factors, such as greener and more pleasant environments, are still debated [35]. Further research is clearly needed.

Food Environments

Food environments encompass both food prepared and consumed at home, and out of home sources. These include vending machines, takeaways, cafes, restaurants, supermarkets and convenience stores [36]. The influence of food environments on dietary intake and adiposity is a research area that has also increased over the past decade, but again, with contradictory evidence. In a systematic review of 38 studies (most assessing the consumption of specific foods, such as fruit or vegetables), moderate evidence was found to support an association between neighbourhood food environments, consumption and/or health [37]; though evidence between fast food availability

and diet was found to be equivocal. However, there is evidence that outlets selling fast food have clustered in areas of deprivation in the UK [38].

Recent studies have also found associations between fast food outlet density and weight in children/adolescents [39, 40]. An England-wide study, covering both heterogeneous socio-demographics and food environments established that the density of fast food and other unhealthy food outlets in neighbourhoods, is linked to higher levels of children who are overweight or obese (while the opposite is true for food outlets selling a range of healthy food); and that association is stronger in older children [41]. Research also suggests an association between higher percentage sales of unhealthy foods at local supermarkets and the prevalence of overweight and obese children among Reception (4-5 year old) and Year 6 (10-11 year old) children [42].

Overall, food prepared out of home tends to be less healthful than food prepared in the home and is associated with fat intake and body fatness [43]. Eating food prepared out of home is a growing trend and makes a substantial contribution to dietary intake [44, 45]. A UK-wide study revealed that a quarter of adults and a fifth of children ate out once a week or more, and a fifth of adults and children ate takeaway meals at least once a week. Rates were highest for children in less affluent households and rates peaked for adults under 30. The research concluded that interventions aimed at reducing out-of-home consumption might be usefully targeted at under 30s, including children and adolescents, to prevent frequent consumption of out-of-home food [46]. In-depth research with older adolescents highlighted that food is regularly consumed outside of the home, particularly from takeaways, fast food outlets, and education establishments [47]. However, qualitative work with this age-group suggests that there are complexities attached to where food is purchased and consumed [48].

A study exploring the multiple environments of home, work, and commuting and takeaway food access in the UK, found those with greatest overall access were nearly twice as likely to be obese compared to those with least access [49]. Further work sought to explore how educational attainment (used as an indicator of socio-economic status (SES)) might modify these observations. In this follow up research, while exposure to fast food outlets was associated with consumption and weight across all education groups, there was an exaggerated impact on the least educated. Lower SES groups consumed more fast food, tended to have higher body weights, and were more likely to be obese [50].

Given that food prepared out of home remains a key concern, understanding the effectiveness of interventions to make takeaway, delivered, or eat-in foods more healthy has been highlighted [51]. A systematic mapping and evidence synthesis of promoting healthy ready-to-eat meals highlighted that, while there has been take up, particularly where proprietors are positive and approaches are cost neutral, there is little evidence thus far on the effectiveness of these approaches[52].

Considering Both PA and Food Environments

Though the research base has burgeoned, exploring environmental influences on both physical activity and diet within the same study remains relatively rare, though international examples exist [53] and a number of themes have been highlighted. For example, an Australian study highlighted that high stress levels found in socially disadvantaged neighbourhoods were associated with poor weight management, less physical activity during leisure time, and frequent fast food consumption in women [54]. In the UK, a study of neighbourhoods with high concentrations of ethnic minorities found a mixed picture of food and physical activity environments. For example, a higher proportion of ethnic minorities lived in deprived areas, fast food outlets were higher, and outdoor recreation opportunities locally scarcer. However, supermarkets and numbers of indoor facilities were higher

for some groups. The study concluded these might contribute to ethnic difference in food choices and engagement in physical activity [55].

US studies of children and adolescents have correlated access to leisure facilities with physical activity, healthy weight, and diet [56, 57]. A French study similarly found that where access to physical activity facilities and general food outlets was low there was a higher risk of children being overweight, but only for lower socio-economic groups and the relationship did not hold true for more affluent children. In the UK, a detailed study of two parks and their peripheral environment, suggested that the quality of park provision and the healthfulness of surrounding food environments favoured the more affluent area[58]. These studies support the concept of 'deprivation amplification'. In other words, poorer neighbourhoods often encompass aspects harmful to health, lacking the healthful resources found in wealthier areas. However, an earlier study of neighbourhoods in Leeds found high levels of obesity prevalent in both poorer and more affluent areas, though, the obesogenic covariates varied widely between the areas studied [59].

Taking a different slant, evidence suggests physical activity and healthy food environments can come together naturally. Garden allotments and community gardens are an example. Growing vegetables has been linked directly to improved diet [60-62], gardening has been demonstrated to provide beneficial physical exercise for adults [63], and allotments provide a safe place for children's outdoor recreation [64]. Gardening has shown to improve mental health, by reducing tension, depression and stress [65, 66 67 63], which is important, since the role of stress in relation to poor weight management is increasingly highlighted [68]. Evaluations have demonstrated the effectiveness of allotment gardening as occupational therapy for recovery from a wide range of injuries, diseases, disorders and conditions [69, 70]. However, inclusion in programmes tackling obesity are rare and more evidence is urgently needed, not least because the number of allotments nationally have decreased dramatically due to the value of land and competing land uses.

Reuniting Planning with Health

A key change over the past five years with a notable impact on policy development has been the move to reunite town planning and public health in the UK. This has happened slightly differently in devolved parts of the UK, but in England, for example, it was principally spurred on by two changes. The National Planning Policy Framework (NPPF) 2012 was the first national planning policy to specifically mention 'healthy communities' as a key aim [72], and the Health and Care Act 2012 transferred responsibility for public health to upper tier local authorities (in other words, the same bodies mainly responsible for planning). This has enabled the possibility of closer working of the two professions through mechanisms such as 'health and wellbeing boards'. It must be recognised, however, that bringing together two professions with very different knowledge bases, institutional settings, and legislative and policy frameworks is not straightforward, and progress has varied between different authorities.

There are however current mechanisms and instruments to integrate health into planning, particularly different types of impact assessments (IA). For example Strategic Environmental Assessments (SEAs) and Environmental Impact Assessment (EIA) are currently required under European Directives for certain plans and project and consideration for health is a key requirement. Though not a statutory instrument, Health Impact Assessments (HIA) can also be applied to a wide range of policies and projects. HIAs provide an opportunity for health evidence to filter through the planning process, in effect mainstreaming it through planning policy hooks[73]. HIAs may be particularly effective when used in conjunction with SEA/EIA.

Some local authorities have also been developing planning policies with health colleagues to specifically address health issues, even before the NPPF. Policies to address the proliferation of hot food outlets are the key example (mostly through Supplementary Planning Documents)[a] . London Borough of Barking and Dagenham's 'Saturation Point' policy, is a good example[74]. This guidance recommends exclusion zones for new takeaways within a 400m 'buffer zone' around a primary or secondary school and restricts outlet clustering. Where hot food takeaways are deemed appropriate, a £1,000 levy is charged for obesity amelioration initiatives. Since adoption, the policy has had some success.

Nationally there is a mixed picture. Generally, local authorities with similar hot food SPD policies report successes, but there are many interrelated problems. For example, many premises not defined as takeaways in planning terms[b] - such as corner shops – also sell energy-dense snack foods and some outlets defined as 'sit down restaurants' also primarily sell unhealthy food. A further complexity is that many local shopping streets in poorer areas are already a 'toxic' mix of takeaways and other unhealthy businesses (payday loan, betting shops, and so on). The supplementary impact of issues such as depression, due to indebtedness, or addictive behaviours associated with gambling on obesity levels in poorer communities, encouraged by the access and availability of these shops and services, is yet to be unravelled; but again research is urgently needed[75].

In terms of planning policies to encourage physical activity, again, more development is needed. As already stated, international research has suggested that, of all built environment influence, access to shops and services, high residential densities, sidewalks, and transit stops may be the most fundamental in supporting physical activity. However, in the UK, provision of pavements (sidewalks) is already universal, and most urban housing is above a threshold for density that is influential [76]. Planners encourage the provision of local shops and services and access to public transport in substantial new housing developments, however these do not always prove viable. Where metrics-driven planning policies around land use mix, diversity have been developed in Australia there is some evidence to show that these policies increase local walking, but the applicability of these to the UK has yet to be seriously considered.

Discussion

While the evidence base around the influence of the built environment has increased significantly over the past decade, there are clearly still gaps in knowledge. The use of varying measures, definitions and approaches and the continual strive to be novel is unhelpful. However, it might be argued that there are strong indications around where change is needed.

Debates around greenspace proximity and physical activity demonstrate the problem of multiple metrics and approaches. However, these also demonstrates a broader issue, for it might reasonably be argued that the health argument for the provision of adequate greenspace has already been clearly established. A number of strands of academic literature have been brought together, demonstrating the healthful nature of greenspaces[77]. These highlight that exposure to greenspaces have beneficial effects on mental health, reducing stress and aiding restoration and providing places for much needed leisure time; and social health by increasing socialisation and social well-being among communities – all factors that in their own way have relationships to obesity. Therefore, establishing whether there is a direct pathway between greenspace, physical activity and obesity at

[a] A Supplementary Planning Document (SPD) forms part of the Councils Local Development Framework (LDF) – the plans for their local area. SPDs must be taken into account when deciding planning permissions.
[b] Hot food takeaway establishments have a special planning land-use category – 'A5'

the neighbourhood level, is less important than examining greenspace quality and which types of provision may promote optimum all round health and well-being.

The importance of the journey to school has been highlighted from both PA and food environment perspectives. The introduction of restrictive planning policies around fast food outlets around schools is an interesting development and demonstrates encouraging cooperation between public health and planning. However, policies have not always been successfully applied, and furthermore there is some evidence of the overturning of planning refusals for outlets by the national Planning Inspectorate; this is cause for concern warranting further investigation. There is also a need to fully understand the proactive interventions that can be taken through the planning system to encourage and maintain active travel to school, but these are still somewhat unclear.

Studies are beginning to capture the multiple environments that people spend their time in. The greater use of increasingly available, reliable and user friendly technology (GPS, accelerometry and so on) will undoubtedly aid this. However currently, technology does not always represent reality. For example one study suggested that modelling underestimated walking route length by 21%, but over-estimated food outlet exposure by 25% [78]. A systematic review of GPS technology (six studies - five from US and one in the UK) found that while use of technology was in its infancy, being able to record and analyse patterns of mobility, is of huge value[79]. However, two issues are apparent. The use of new technologies unfortunately may only increase the diversity of methods and metrics that has plagued obesogenic environment research from its inception. Furthermore, human perception must not be overlooked in the rush for more measurement. Research has shown that perception is a mediator between objectively measured exposure and interaction. Studies combining both measures are therefore preferable, but are still rare.

Another important theme relates to obesity impacting the poorest in society at higher levels than the more affluent; the reasons for this are not always clear. Some studies of the built environment appear to support the concept of deprivation amplification, but not all. Burgoine's observations, that the less educated seem to have an exaggerated impact from exposure to fast food outlets, may begin to provide an explanation[50]; and this line of enquiry might be usefully applied to PA too. Overall the links between PA, food access, built environment and deprivation require more research. However, the opportunities that the built environment provides for healthy food access and exercise, for example the provision of community gardens, allotments and so on, and the impact these may have on overweight and obesity also deserve more examination.

While the evidence base is, therefore, imperfect and there are many gaps in the knowledge, it may also be argued that there is certainly enough to act on now. The opportunity for planners and health professionals to work together provides a crucial step forward towards the 'whole systems approaches' to tackle obesity that are called for by the Foresight report[81]. However, progress towards this goal seems slow. One problem is the level of inertia in both policy and practice pertaining to the built environment. Planners already juggle a huge number of competing interests and are often under pressure to meet decision-making targets. A convincing argument about why health should be prioritised in the planning system, therefore needs to be made. Aligning health with current sustainability priorities is one way. For example creating health supportive environments that improve active travel levels, would also diminish the production of harmful greenhouse gases, reduce particulate pollution from lower traffic levels, decrease pedestrian and cyclist accidents and deaths, and in turn help reduce the huge financial burden of treating obesity-related disease on the NHS, to summarise a few significant issues. However, importantly, rather than setting 'health' up as yet another 'goal' of planning to compete against issues of sustainability,

economic regeneration and on, more importantly health and well-being should be embedded as the 'golden thread' that runs through all built environment policy.

Furthermore and in relation to the development industry, the argument about the marketability of 'healthy development', also needs to be made. Again evidence already exists to support the argument that developers can charge a premium for developments with stronger place identity, adding in health supportive elements such as quality greenspace and landscaping is a key element of this. This message needs to be more forcibly made to the development industry, though here there is also a role here for planning to ensure these do not become the domain of a privileged minority. There is, therefore, a key role for training and education build environmental professionals with regard to these goals, but this will take time to feed through. More immediately public health professionals need to be somewhat tenacious in their approaches to influence decisions around the built environment.

Conclusion

In the UK the burden of obesity contributes to increasing health inequality, individuals' lives are severely impacted and rates are still rising, placing health care systems under huge strain. While there is an imperfect evidence base relating to the role of the built environment in the obesity crisis, planning and health professionals must work together and take action now where current evidence suggests changing policy and practice could be effective.

There are areas for immediate action. Firstly a wider more consistent use of HIA would allow for more cooperation between health and planning colleagues in local authorities, for example improving the translation of public health evidence (often collated at population level) to the local context to help deliver environments that support increased physical activity and improved mental wellbeing. Moreover a thorough review of hot food takeaway guidance and policy is needed to understand where it has been most effectively applied and why local decisions have not always been upheld in the appeal process. This will improve the quality and robustness of policy in the future, not just in relation to fast food, but to other areas where planning policy is needed to support healthier lifestyle choices. Mechanisms to enable the two professions to work together more effectively need immediate attention, as well as the sharing of good practice, while longer terms the training and education of both professions should facilitate inter-disciplinary cooperation and understanding.

The alignment of health concerns and planning will not happen overnight and linking them only addresses a certain part of the obesity systems map. However given the generally enduring nature of the built environment - its impact will be usually be spread over several generations - the importance of this cannot be overestimated.

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